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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/630,452
Filing Date: July 30, 2003
Appellant(s): RITTER ET AL.

Jon E. Holland
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 8/15/2007 appealing from the Office action mailed 3/20/2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,384,834	Watanabe	5-2002

Malzbender, Tom, et al., Proceedings of the 28th annual conference on Computer graphics and interactive techniques, August 2001)

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe (US patent 6,384,834) in view of Malzbender et al ("Polynomial texture maps", Malzbender, Tom, et al., Proceedings of the 28th annual conference on Computer graphics and interactive techniques, August 2001).

a. Watanabe teaches a texture mapping system, comprising:

-- for Claim 1, memory for storing a parametric texture map, the parametric texture map having a plurality of texels defining a first texture; (Fig. 1; column 7, line 66 to column 8, line 43; storage 242 of Fig. 12; *column 12, lines 7-39; Storage 242 stores vertex texture coordinates, such as (VTX0, VTY0), of vertices of a polygon. The vertex texture coordinates are parameters*

used for a texture coordinate (VTX, VTY) to texture map dots on the polygon. The texture information specified with the vertex texture coordinates forms a parametric texture map.)

-- for Claim 1, a texture map manager configured to perform a rotation of the first texture thereby providing a parametric texture map defining a second texture that is rotated relative to the first texture, the texture map manager further configured to adjust at least one of the texels to compensate for the rotation. (Fig. 1; column 1, lines 13-61; column 7, line 66 to column 8, line 43; Figs. 13-15 and 17; *Fig. 14 shows a how the vertex texture coordinates and texture coordinate are transformed under rotation from a first texture map specified by the vertex texture coordinates associated with the original vertices to those associated with the rotated vertices to form a second texture. The transformation also compensates the effect of rotation on the texture map. The applicants alleged that the rotation is for a whole car not for a texture. The Examiner disagrees. Fig. 17 clearly shows that the texture is applied to a tire modeled as a combination of polygons and having running surface 33 and side surface 32. Each of the surfaces is specified by a texture at any rotation angle. The generation and application of texture map is most relevant to the recited claimed feature, because its texture is generated with the method described in Fig. 14.)*

However, Watanabe does not teach the recited feature related to "light direction" and especially "a variable expression that defines a luminosity parameter as a function of light direction".

Malzbender teaches a texture mapping approach, comprising:

-- for Claim 1, a parametric texture map, the parametric texture map having a plurality of texels, each of the texels defining a variable expression that defines a luminosity parameter as a function of light direction. (section 3.2)

It is desirable to improve realism of 3D image rendering. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to use Malzbender's polynomial texture maps to specify direction-dependent lighting effect on texture information associated with dots in each polygons to render Watanabe's image (at least the running surface 33 of Fig. 17) at the perspective viewing angles of surfaces of an object during rotation, because the combination improves realism of 3D image rendering of rotated image. The combination thus teaches:

-- memory for storing a parametric texture map, the parametric texture map having a plurality of texels defining a first texture, at least one of the texels defining a variable expression that defines a luminosity parameter as a function of light direction;

-- a texture map manager configured to perform a rotation of the first texture thereby providing a parametric texture map defining a second texture that is rotated relative to the first texture, the texture map manager further configured to define a variable expression for a texel of the parametric texture map defining the second texture by adjusting the variable expression of the one texel to compensate for a change in relative light direction resulting from the rotation.

Malzbender further teaches:

-- for Claim 2, wherein the variable expression of the one texel defines a luminosity behavior for the one texel; (section 3.2)

-- for Claim 3, wherein the variable expression of the one texel is defined according to the equation defined in Claim 3. (equation 5)

b. Claim 5 is a "computer-readable medium" claim corresponding to Claim 1. Watanabe teaches that the method can be implemented by software means using a general-purpose processor (column 14, lines 46-51). Because the software has to reside in a storage medium in the processor for the disclosed processing, the combination of Watanabe and Malzbender as discussed above also teaches Claim 5.

c. Evidently, the above discussion also shows that the combination of Watanabe and Malzbender also teaches the texture mapping system recited in Claim 6, the texture mapping methods recited in Claims 7-9 and 11-13.

d. For Claims 15 and 16, Watanabe further teaches:

-- applying the rotated texture to a graphical object; (column 11, line 47 to column 12, line 39; column 13, lines 30-44; Texture map is applied to each polygon, including a rotated running surface.)

-- displaying the graphical object. (column 11, lines 12-25; column 1, lines 13-62; Figs. 13, 20; element 10 of Fig. 12)

Therefore, the combination of Watanabe and Malzbender also teaches applying the rotated texture based on the variable expression for the texel defining the portion of the second texture.

e. With regard to Claims 4, 10, and 14, the recited expression is an obvious result of transformation from a vector to another due to rotation. When an object, such as the running surface of a tire, is rotated, the light vector with respect to the texture surface coordinates changes accordingly. The transformation represented in paragraphs [0101]-[0109] of the present application is just the change of parameters because the change of the direction of a light vector.

So when one applies Watanabe's teaching to rotate Malzbender's polynomial texture map, one inherently will reach the same expression recited in Claims 4, 10, and 14. Therefore, combination of Watanabe and Malzbender as discussed above also teaches Claims 4, 10, and 14.

(10) Response to Argument

A. Overview of rejections

As shown above, Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe (US patent 6,384,834) in view of Malzbender et al ("Polynomial texture maps", Malzbender, Tom, et al., Proceedings of the 28th annual conference on Computer graphics and interactive techniques, August 2001).

Watanabe teaches three-dimensional image simulation and synthesis which realistically simulate the real world when the velocity, rotational velocity, or surface state of a display object has changed. In the simulation, an image synthesis section (200) shown in Fig. 12 contains a texture computation section (230) for performing computations to map textures onto the display objects and a texture information storage section (242) for storing information of the textures to be mapped. Different types of texture information are stored in the texture information storage section (242) for the same display object. Either the type of information of the texture to be mapped onto the display object or information specifying that type is changed in accordance to the velocity, rotational velocity, or surface state of the display object or their combination.

For example, Storage 242 stores vertex texture coordinates, such as (VTX0, VTY0), of vertices of a polygon. The vertex texture coordinates are parameters used for a texture coordinate

(VTX, VTY) to texture map dots on the polygon. The texture information specified with the vertex texture coordinates forms a parametric texture map. (Watanabe: Fig. 1; column 7, line 66 to column 8, line 43; storage 242 of Fig. 12; column 12, lines 7-39) Furthermore, Fig. 14 shows how the vertex texture coordinates and texture coordinate are transformed under rotation from a first texture map specified by the vertex texture coordinates associated with the original vertices to those associated with the rotated vertices to form a second texture. The transformation also compensates the effect of rotation on the texture map. Fig. 17 shows that the texture is applied to a tire modeled as a combination of polygons and having running surface 33 and side surface 32. Each of the surfaces is specified by a texture at any rotation angle. (Watanabe: Fig. 1; column 1, lines 13-61; column 7, line 66 to column 8, line 43; Figs. 13-15 and 17) In summary, Watanabe teaches transforming texture maps and applying the maps to surfaces of various parts of a car for image synthesis in three-dimensional image simulation. In the simulation, a car moves and wheels rotate. *When a tire on a wheel is rotated, its associated vertex texture coordinates and texture coordinate are transformed.*

It is well known in the image simulation that a 3D image simulation is based on illumination conditions such as relative location and direction between the car and tires and light source, such sun or lamps. However, Watanabe does not teach the recited feature related to "light direction" and especially "a variable expression that defines a luminosity parameter as a function of light direction".

As pointed out in the last Office Action that Malzbender remedies this deficiency. *Malzbender teaches a* ***texture mapping, same art as Watanabe,*** *approach for increasing photorealism.* (abstract) Photorealism is a measure how image synthesis realistically simulates

the real world. Especially, *Malzbender teaches* an approach comprising a *parametric texture map*, wherein the parametric texture map has a plurality of texels, *each of the texels defining a variable expression that defines texture through a luminosity parameter as a function of light direction*. (Malzbender: section 3.2)

It is desirable to improve realism of 3D image rendering. *Malzbender points out explicitly in its abstract its advantage of producing* ***increased photorealism****. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to use Malzbender's polynomial texture maps to specify direction-dependent lighting effect on texture information associated with dots in each polygons to render Watanabe's image (at least the running surface 33 of Fig. 17) at the perspective viewing angles of surfaces of an object during rotation*, because the combination improves realism of 3D image rendering of rotated image.

B. <u>Detailed responses</u>

- Applicants' argument

Applicants assert that the alleged combination of Watanabe and Malzbender fails to suggest at least the features of claim 1 highlighted in page 7 of the Appeal Brief. (a) Especially, Applicants agree that Malzbender describes texture maps having a texel "defining a variable expression that defines a luminosity parameter as a function of light direction," but Applicants submit that Malzbender fails to suggest defining "a variable expression for a texel" by "adjusting" a texel's variable expression "to compensate for a change in relative light direction resulting from the rotation," as described by claim 1.

(b) Malzbender fails to suggest that the "variable expression" of a texel should be "adjusted" to define a new "variable expression" in order to compensate for a texture rotation.

(c) The differences presented in the Appeal should be viewed in light of the different purposes of the variable expression evaluations described by Malzbender and the variable expression adjustments recited by claim 1.

Examiner's response

The Examiner disagrees. Malzbender indeed teaches this feature in section 2.3 (3.2 Polynomial Color Dependence), especially related to equations (4) and (5). The set of $R(u,v)$, $G(u,v)$, and $B(u,v)$ of equation (4) defines a texel at local texture coordinate (u,v). Collection of the texels forms a texture map. The set is generated by multiplying an unscaled color per texel $Ru(u,v)$, $Gu(u,v)$, and $Bu(u,v)$ with $L(u,v)$ which again depends on the texel coordinates and light vectors as defined in equation (5).

How Malzbender meets the above limitation is explained below. *Please note that in the present application (u, v) are used to define components of a light vector while in Malzbender* (l_u, l_v) *are used to define components of a light vector.*

Let define light direction for a first texture as (l_{u1}, l_{v1}) with light incident at a first direction. The first texture is defined as:

$R(u,v) = L(u,v;l_{u1}, l_{v1})\, Ru(u,v)$,

$G(u,v) = L(u,v;l_{u1}, l_{v1})\, Gu(u,v)$,

$B(u,v) = L(u,v;l_{u1}, l_{v1})\, Bu(u,v)$,

with the definitions of the terms defined in Malzbender.

This provides a parametric texture map defining a first texture. When the texture is rotated relative to the first texture to become a second texture, light direction for the second texture is changed to (l_{u2}, l_{v2}). The second texture is **adjusted by changing $\mathbf{L}(u,v;l_{u1}, l_{v1})$ to $\mathbf{L}(u,v;l_{u2}, l_{v2})$** in the above equations and become

$$R(u,v) = L(u,v;l_{u2}, l_{v2})\ Ru(u,v),$$

$$G(u,v) = L(u,v;l_{u2}, l_{v2})\ Gu(u,v),$$

$$B(u,v) = L(u,v;l_{u2}, l_{v2})\ Bu(u,v).$$

The changing is for compensating for the change in relative light direction resulting from the rotation. Because each equation above depends on variables u,v, l_u, and l_v, ***each equation is a variable expression***.

With regard to argument point (a) above, as explained above, Malzbender indeed teaches:

"to define a variable expression for a texel of the parametric texture map defining the second texture by adjusting the variable expression of the one texel to compensate for a change in relative light direction resulting from the rotation".

With regard to argument point (b) above, the second set of equations is a set new expressions.

With regard to argument point (c) above, the argument is irrelevant because the different purpose of a claimed feature other than that referred in a reference is not a basis of rendering a claim patentable against the cited reference. As pointed above, the cited combination can achieve the obvious advantage.

- Applicants' argument -- Applicants argue that Watanabe fails to remedy the deficiencies of Malzbender.

Examiner's response -- As explained above, the Examiner did not rely on Watanabe to remedy the deficiencies of Malzbender.

- Applicants' argument -- With respect to Claims 4, 10, and 14, the rotation of a graphical object, such as a "tire," with respect to a simulated light source illuminating the graphical object may result in a different light vector (e.g., different values of u and v) for a particular pixel of a graphical object. However, as described above in the Discussion of 35 U.S.C. $103 Rejections of Claims 1-3, 5-9, 11-1 3, 15, and 16, according to the teachings of the cited art, such a rotation would presumably be accommodated by evaluating the variable expressions of a "parametric texture map" for different light values, u and v, as the graphical object is being rotated and the light direction from the simulated light source is changing. There is nothing in the cited art to suggest that the rotation of a graphical object should result in adjustment of a "variable expression" for a texel to define a "variable expression" of a "parametric texture map" defining a rotated texture. Accordingly, the cited art fails to suggest at least the equation recited by claim 4.

Examiner's response -- As responded above, the combination of Watanabe and Malzbender indeed teaches adjustment of a "variable expression" for a texel to define a "variable expression" of a "parametric texture map" defining a rotated texture. The argument is thus not persuasive. Furthermore, *Please note again that in Malzbender (l_u, l_v), not u and v, are used to define components of a light vector.* As for record, the Applicants did not challenge the Examiner's conclusion that the equation recited in Claim 4 is an obvious result of vector transformation and equation recited in Claim 3.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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October 19, 2007

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